REMARKS

Claims 1-8 and 10-57 are pending in the above referenced application. Claims 1-8 and 10-57 are rejected. Claims 1, 6, 32, 36 and 39 are currently amended. Claims 4, 5, 7, 8 and 41 are canceled without prejudice.

Applicants respectively request reconsideration in view of the following claim amendments and remarks.

I. 35 U.S.C. § 112 Claim Rejections

Claim 36 is rejected under 35 U.S.C. §112, second paragraph, as being indefinite for allegedly failing to particularly point out and distinctly claim the subject matter which the applicant regards as the invention. The Office Action states that there is insufficient antecedent basis for a "planarized surface" in either claim 36, 33, 31, 30, or 29. Claim 36 has been amended to correctly state that it is dependent upon claim 35.

II. 35 U.S.C. § 102(e) REJECTIONS

Claims 1- 4, and 10 stand rejected under 35 U.S.C. §102(e) as allegedly being anticipated by Daneman *et al.* (US 6,528,887). The Office Action states that Daneman *et al.* discloses a MEM device comprising a movable micromachined structure, and a conductive diamond material defining an abrasion resistive contact area (read as resistive to stiction), disposed along a surface of the structure and the device operates as a switch with a lever mechanism that is inherently subject to abrasion as it closes.

The applicant respectfully disagrees. To anticipate a claim, "each and every element set forth in the claim [must be] found, either expressly or inherently described, in a single . . . reference." *Verdegall Bros. V. Union Oil Co. of California*, 814 F.2f 628, 631 (Fed. Cir. 1987) (M.P.E.P. Section 2131). Applicants have currently amended independent claim 1 to expressly recite a movable micromachined structure "**comprising a rib enforced lever mechanism.**" Support for the amendment is found in previous dependent claims 4 and 5, and in the original specification. Consequently, because Daneman *et al.* does not teach or suggest a movable micromachine structure "**comprising a rib enforced lever mechanism**", Daneman *et al.* does

Cabot Microelectronics Corporation
870 North Commons Drive
Aurora, IL, 60504
Tel. (630) 375-2033

not to teach every element of the claimed invention and, hence, does not anticipate amended claim 1. As a consequence, claim 1 is allowable for at least all of the reasons stated above. Claims 2-4 and 10 are dependent on allowable independent claim 1 and are, therefore, allowable for at least the reasons stated above.

Claims 11, 13-19 and 27-28 are rejected under 35 U.S.C. §102(e) as allegedly being anticipated by De Los Santos *et al.* (US 6,040,611). The Office Action states that De Los Santos *et al.* disclose a MEM device comprising a movable mechanism residing adjacent a substrate; and abrasion resistant material (read as stiction resistive material) localized on a first portion of the movable mechanism; a first contact region localized on the substrate that attracts the movable mechanism toward the substrate such that the abrasion resistant material becomes operationally coupled to a second contact region comprising an abrasion resistive material that resides on the substrate, wherein the second contact material is similar to the first portion material; the second contact region comprising a first RF contact portion and a second RF contact portion such that the movable mechanism shorts the first and second RF contacts; a third contact region operable to pull back the moveable mechanism from being attracted to the second contact region; the moveable mechanism further comprising a first anchor portion and a second anchor portion integral to a top surface of the substrate, wherein the first anchor portion is a dielectric layer that prevents the lever mechanism from physically coupling to the third contact region when the first contact region is energized. The Office Action further states that it is inherent that the portion of the mechanism would be subject to abrasion as the first portion of the mechanism becomes operationally coupled to the second contact region.

The applicant respectfully disagrees. The De Los Santos *et al.* patent describes a MEMS device requiring only a low actuation voltage to effect switching. The De Los Santos *et al.* patent does not teach an abrasion resistant material located on a first portion of a movable mechanism. The De Los Santos *et al.* patent does teach that by proper pivot design and properly phasing the magnitudes of the primary control electrodes, the rate of the switching action and the speed of contact between the interconnection lines and the contact pads can be controlled to extend

Cabot Microelectronics Corporation
870 North Commons Drive
Aurora, IL, 60504
Tel. (630) 375-2033

contact life. The stiction resistance noted in the office action refers to the alternate process described, whereby a dielectric layer is incorporated to reduce the possibility of beam sticking. Thus, the stiction resistance is resistance to the unintentional adhesion of MEMS surfaces. The stiction resistance has no relation to abrasion resistance. Therefore, De Los Santos *et al.* does not to teach every element of the claimed invention and, hence, does not anticipate independent claim 11 or claims dependant therefrom.

Claim 37 is rejected under 35 U.S.C. § 102(b) as allegedly being anticipated by Huang *et al.* (US 6,384,353). The Office Action states that Huang *et al.* discloses a MEM device comprising a movable mechanism residing adjacent a substrate; an abrasion resistant material (tungsten) localized on a first portion of the movable mechanism; a first contact region that attracts the movable mechanism toward the substrate such that the abrasion resistant material becomes operationally coupled to a second contact; and further comprising an integral enclosure to enclose the MEM device.

The applicant respectfully disagrees. Huang *et al.* teaches a MEMS device with a protective cap. The protective cap of Huang *et al.* is bonded by a bonding layer at the bonding perimeter, placed over MEMS component such that it mates with a substrate trace. The protective cap of Huang *et al.* is placed over the MEMS device and is not an integral enclosure. The Huang *et al.* patent does not teach every element of the claimed invention and, hence, does not anticipate claim 37.

Claims 39-40, 42-50 and 52-57 are rejected under 35 U.S.C. § 102(b) as allegedly being anticipated by Tilmans *et al.* (US 6,297,072). The Office Action states that Tilmans *et al.* discloses an integral micro-machined structure for enclosing a MEM device and method of manufacture thereof, comprising providing a substrate, fabricating a vertical structure extending from the substrate (switch in cavity area) and fabricating a cover over the substrate structure, wherein the cover defines a tortuous channel (labyrinth path) and covers plurality of MEM devices, sacrificial material is removed through the channel and a sealing member engaging the channel; and an inert gaseous material or vacuum sealed state inside the enclosure.

Cabot Microelectronics Corporation
870 North Commons Drive
Aurora, IL, 60504
Tel. (630) 375-2033

The applicant respectfully disagrees. Tilmans *et al.* describes a method of fabricating a microstructure having an internal and preferably sealed cavity. Tilmans *et al.* do not describe a micro-machined structure defining at least one tortuous path. Additionally, claim 39 has been amended to bring in the limitation of a contact region, on the substrate structure, acting as a pull-back contact for a MEM residing on said substrate. Tilmans *et al.*, therefore, does not teach every element of the claimed invention and, hence, does not anticipate claims 39-40, 42-50 and 52-57.

III. 35 U.S.C. § 103(a) REJECTIONS

Claim 5 is rejected under U.S.C. 103(a) as being allegedly unpatentable over Daneman *et al.* in view of Lin *et al.* (NPL reference "U"). The Office action states that Daneman *et al.* discloses all of the elements of the claim, but fails to explicitly teach the lever mechanism to have a rib enforced lever. The Office Action relies upon Lin *et al* to provide a movable micromachine switch structure using a rib enforced lever. The Office Action asserts that one of ordinary skill in the art would have been motivated to use the rib enforced lever of Lin *et al* because a rib enforced lever was known to increase the lever stiffness and prevent deformation of the lever.

The applicant respectfully disagrees. Daneman *et al.* describe a MEMS device with a flap movably attached to the device by one or more flexures. The flap may include a reflecting surface so that the device acts as a MEMS mirror. The flap described by Daneman *et al.* is not a lever mechanism. Additionally, Daneman *et al.* provide no suggestion of any benefit of a more rigid flap. The Lin reference, on the other hand, teaches that with a rib-reinforced structure, the bending stiffness of a lever arm can be significantly increased, leading to an improved performance of the lever mechanism. A person of skill in the art would not be motivated to use the rib-reinforced lever of Lin in the switch of Daneman *et al.* because Daneman *et al.* uses a flap, not a lever. Additionally, a person of skill in the art would not be motivated to use the rib-reinforced lever of Lin *et al.* because the intended function of a reflecting surface described by Daneman *et al.* would be destroyed by the proposed modification of a rib-reinforced structure.

Claims 6-8 are rejected under U.S.C. 35 103(a) as allegedly being unpatentable over Daneman *et al.* in view of Huang *et al.* The Office Action states that Daneman *et al.* discloses all of the elements of the claims including a micro-machined structure, but does not explicitly teach an integral enclosure having an aperture over the structure. The Office Action relies upon Huang *et al.* to provide the micro-machine structure with an integral enclosure having an aperture over the structure.

The applicant respectfully disagrees. Claims 7 and 8 have been canceled without prejudice. Claim 6 has been amended to include the limitation of **said enclosure defining an integral enclosure.** Support for this amendment is found in canceled claim 8 and in the original specification. The Huang *et al.* patent describes a protective cap covering a MEMS device. The protective cap of Huang *et al.* is described as having a bonding layer at the bonding perimeter placed over the MEMS component such that it mates with the substrate trace. Therefore, the protective cap of Huang *et al.* is not an integral structure, and combining it with the structure of Daneman *et al.* would not lead a person of ordinary skill in the art to the invention of claim 6.

Claim 12 is rejected under U.S.C. 35 §103(a) as allegedly being unpatentable over De Los Santos *et al.* in view of Daneman *et al.* The Office Action states that De Los Santos *et al.* disclose all the elements of the claim, but fails to explicitly teach the use of a diamond material as an abrasion resistant material. The Office Action relies upon Daneman *et al.* to provide the MEM device comprising a movable mechanism with a diamond abrasion resistant material on a first portion of the movable mechanism.

The applicant respectfully disagrees. The De Los Santos *et al.* patent describes a MEMS device having a pivoting beam and primary control electrodes. The De Los Santos patent states that by proper design and properly phasing the magnitudes of the primary control electrodes, the rate of switching action, the contact between the interconnection lines and the contact pads can be controlled, thus extending contact life. One of ordinary skill in the art would not have been motivated to use the diamond material of Daneman *et al.* in the device of De Los Santos *et al.*

Cabot Microelectronics Corporation
870 North Commons Drive
Aurora, IL, 60504
Tel. (630) 375-2033

because the latter teaches preventing contact wear by controlling the movement of the contact pads through a flexible pivot design and primary control electrodes. Quoting *in re Gordon*, 733 F2d 900, 902, 221 U.S.P.Q. 1125, 1127 (Fed. Cir. 1984) "[t]he mere fact that the prior art could be so modified would not have made the modification obvious unless the prior art suggested the desirability of the modification." Clearly there is no suggestion of desirability of a diamond abrasion resistant material for the contact region in the device of De Los Santos *et al.*

Claims 20-23, 29-31, 34-36 and 38 are rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over De Los Santos *et al.* in view on Lin *et al.* The Office Action states that the process limitation of planarization by chemical-mechanical polishing found in claims 22 and 23 invoke the product-by-process doctrine, and that the claims are not limited to the manipulations of the recited steps, only the structure implied by the steps. The Office Action further states that De Los Santos *et al.* teach all of the elements of claims 20-23, but fails to explicitly teach a second surface on the mechanism comprising a metallic rib. The Office Action relies upon Lin *et al.* to teach a movable micro-machine switch structure using a metallic rib enforced lever. The Office Action asserts that it would have been obvious to one of ordinary skill in the art at the time of the invention to use the metallic rib enforced lever of Lin *et al.* in the switch mechanism of De Los Santos *et al.*

With respect to claims 29-31, 34-36, and 38, the Office Action asserts that De Los Santos *et al.* discloses a many of the features of the MEM switching device, but fails to teach an integral conductive rib on the lever mechanism. The Office Action relies upon Lin *et al.* to teach a movable micro-machine switch using an integral conductive rib enforced lever. The Office Action states that it would be obvious to one of ordinary skill in the art to use the integral conductive rib enforced lever of Lin *et al.* in the switch mechanism.

The applicant respectfully disagrees. The rib enforced design of Lin *et al.* is intended to increase the lever stiffness. The MEM device of De Los Santos *et al.* comprises a flexible cantilever beam positioned orthogonally to the interconnect lines (described as 28 in Figure 2). The rib enforced lever of Lin *et al.* would destroy the intended function of the flexible cantilever

described in the De Los Santos patent. Therefore, a person of ordinary skill in the art would not have been motivated to combine these references.

Claims 24-26 and 32 are rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over De Los Santos *et al.* in view of Lin *et al.* and further in view of Huang *et al.* The Office Action states that De Los Santos *et al.* in view of Lin *et al.* teaches all of the elements of the above mentioned claims including a pull-back contact, but fails to explicitly teach an integral enclosure comprising an electrical field. The Office Action relies upon Huang *et al.* to provide the MEM switch device with an integral enclosure comprising an electrical shield. The Office Action asserts that it would have been obvious to one of ordinary skill in the art to use the enclosure of Huang *et al.* in the movable mechanism device as described by De Los Santos *et al.* in view of Lin *et al.* Additionally, the Office Action states that De Los Santos *et al.* in view of Lin *et al.* do not teach the conductive rib material to be copper. The Office Action relies upon Huang *et al.* to teach a MEMS device wherein the lever material is copper. The Office Action asserts that it would have been obvious to one of ordinary skill in the art to use the conductive copper material of Huang *et al.* in the rib enforced lever as described by De Los Santos *et al.* in view of Lin *et al.*

The applicant respectfully disagrees. As described above, the enclosure of Huang *et al.* is not an integral enclosure. The present invention teaches and claims an integral enclosure. Furthermore, Huang *et al.* talks about preventing RF losses only with respect to the prior art, and only with respect to the packaging substrate. Therefore, Huang *et al.* is not a proper reference as it does not teach any element of the rejected claims and it does not provide any motivation to modify the prior art. With respect to claim 32, for the reasons stated above, De Los Santos *et al.* in view of Lin *et al.* do not teach all of the elements of the claims, including a pull-back contact. Huang *et al.* teaches an electrode forming a cantilever comprising a dielectric layer and a layer identified as **134**, which may be copper. Copper is selected for having minimum stiffness and low thermal expansion coefficient. Again, the De Los Santos *et al.* device is a flexible cantilever. One of ordinary skill in the art would not have been motivated to combine the prior

art references because of the stated requirement for flexibility in the cantilever of De Los Santos *et al.* is contrary to the present invention, and the Huang *et al.* teaching of a cantilever requiring two materials. The invention of claim 32 describes a rib enforced lever mechanism comprising a rib that is integral to the lever mechanism, the rib being copper. Claim 32 has been amended to correctly state that it is dependant from claim 31. No new matter enters with this amendment.

Claim 33 is rejected under 35 U.S.C. 103(a) as allegedly being unpatenable over De Los Santos *et al.* in view of Lin *et al.* and further in view of Daneman *et al.* The Office Action states that De Los Santos *et al.* in view of Lin *et al.* teaches all of the elements of claim 33, but fails to explicitly teach the conductive rib material to be diamond. The Office Action relies upon Daneman *et al.* to teach a MEM switch device wherein the lever material comprising diamond. The Office Action asserts that it would have been obvious to one of ordinary skill in the art at the time of the invention to use the conductive diamond material of Daneman *et al.* in the rib enforced lever as described by De Los Santos *et al.* in view of Lin *et al.*, because diamond is well known in the art to be extremely hard and abrasion resistant, and thus would improve the performance of the device.

The applicant respectfully disagrees. For the reasons stated above, De Los Santos *et al.* in view of Lin *et al.* does not teach all of the elements of claim 33. Furthermore, the conductive diamond film of the Daneman *et al.* patent is defined as a landing pad. The subject claim describes a rib enforced lever mechanism comprising a rib that is integral to the lever mechanism and is comprised of a conductive diamond layer. Even if De Los Santos *et al.* in view of Lin *et al.* had taught the remaining elements of claim 33, which they don't, one of ordinary skill in the art would not have been motivated to combine the diamond material of Daneman *et al.* without the knowledge learned from the applicant's disclosure.

Claims 41 and 42 are rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over Tilmans *et al.* in view of De Los Santos *et al.* The Office Action states that Tilmans *et al.* discloses all of the elements of the claims, but fails to explicitly teach the structure to comprise a contact region acting a pull-back contact for a MEM device and acting as a shield for

electromagnetic radiation. The Office Action relies upon the micro-machined structure of De Los Santos *et al.* to teach a contact region acting as a pull-back contact for a MEM switch device and as a shield for electromagnetic radiation. The Office Action asserts that it would have been obvious to one of ordinary skill in the art at the time of the invention to use the contact region of De Los Santos *et al.* in the micro-machined structure of Tilmans *et al.*, because including a pull-back mechanism would have decreased the overall switching time of the device and an electromagnetic shield would have prevented signal loss, thus improving the performance of the device.

The applicant respectfully disagrees. Claim 39 has been amended to include the limitations of claim 41. Claim 41 has been canceled. Tilmans *et al.* describes a method of fabricating a microstructure having an internal and preferably sealed cavity. Tilmans *et al.* do not describe a micro-machined structure defining at least one tortuous path. Therefore, Tilmans *et al.* does not describe all of the elements of claims 39 and 42, in addition to the structure comprising a contact region acting as a pull-back contact for a MEM device and acting as a shield for electromagnetic radiation. The contact region described by De Los Santos *et al.* is a primary control electrode positioned on top of the substrate (Figure 7, 38a; column 4 lines 24-40). It is not a contact region acting as a pull-back contact for the MEM device residing on a substrate. Additionally, the metal/dielectric layer, cited by the Office Action as inherently acting as a shield for EM radiation, is a thin dielectric layer, deposited as thin as possible, to reduce the possibility of the beam sticking upon application of voltage. The metal/dielectric layer as described by De Los Santos would not prevent the passage of EM radiation. A person of ordinary skill in the art would not have had any suggestion or motivation to select the elements needed to arrive at the claimed invention without the prior knowledge of the applicant's disclosure.

Claim 51 is rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over Tilmans *et al.* in view of Daneman *et al.* The Office Action states that Tilman *et al.* discloses all the elements of the claim, but fails to explicitly disclose the MEM device comprises diamond.

Cabot Microelectronics Corporation
870 North Commons Drive
Aurora, IL, 60504
Tel. (630) 375-2033

The Office Action relies upon Daneman *et al.* to teach a micro-machined structure wherein the device comprises diamond. The Office Action asserts that it would have been obvious to one of ordinary skill in the art at the time of the invention to use the diamond material of Daneman *et al.* in the device of Tilmans *et al.*, because diamond was well known in the art to be extremely hard and abrasion resistant.

The applicant respectfully disagrees. For the reasons stated above Tilmans *et al.* does not disclose all of the elements of claim 51. Furthermore, Daneman *et al.* teach conductive landing pads comprising conductive diamond film. The prior art references cited here provide no suggestion of the desirability of the modifications needed to arrive at the claimed invention of micro-machined structure comprising diamond, enclosing at least one MEM device. It is well established that the fact that prior art could be so modified does not make the modifications obvious absent the suggestion of the desirability of the modifications.

For at least the reasons stated above, the applicants respectfully request that the rejections under 35 U.S.C. 103(a) be withdrawn.

In view of the remarks and amendments above, the applicants respectfully submit that the present application is in condition for allowance and solicits action to that end. If there are any additional matters that may be resolved or clarified through a telephone interview, the Examiner is respectfully requested to contact applicant's undersigned representative.

Respectfully submitted,

By: Thomas Omholt

Thomas Omholt
Reg. No. 37,052

Cabot Microelectronics Corporation
870 North Commons Drive
Aurora, IL, 60504
Tel. (630) 375-2033